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Research Article

PHARMACEUTICO-ANALYTICAL STUDY OF *ANILARI RAS*: A HERBO MINERAL COMPOUND

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ABSTRACT

Rasasastra is a branch of Ayurvedic medicine which deals with preparation of the drugs with metals and minerals having higher therapeutic efficacy with quick action in minute dose. Present preparation *Anilari Ras* is a herbo-mineral formulation used for treating all types of *Vata* disorders. This drug is a variety of *Tamra bhasma* (incinerated Copper) preparation processed with *Shodit parad* (Purified Mercury), *Shodit Gandhak* (Purified Sulphur), *Shodit Tamra* (Purified Copper) and *Bhavana dravyas* (liquids used for trituration) are *Nirgundi patra swarasa* (*Vitex negundo* Linn.), *Eranda mula kashaya* (*Ricinus communis* Linn) a*nd Citraka mula kashaya* (*Plumbago zeylanica* Linn). Triturating Rasa drugs with herbal liquids (*Bhavana*) increases the efficacy of formulation. *Puta* in the preparation imparts *Laghutva* (easily assimilating) property, helps in particle reduction and facilitates nano particle formation which enhances rapid action of the medicine. The pharmaceutically developed drug was subjected for certain Analytical tests like Organoleptic, Physico-chemical, Scanning Electron Microscope (SEM), Energy- Dispersive X-ray Spectroscopy (EDS) and *X-ray diffraction* (XRD), with a view to standardize the formulation. The results show major peaks of Meta Cinnabar (HgS), Covellite (CuS) and minor peaks of Sulphur (S_8). The Average grain size in SEM at 5K X is 218.4 nm and at 7K X is 210.0 nm.

INTRODUCTION

Rasasastra is a branch of *Ayurvedic* medicine, which deals with preparation of the drugs with metals and minerals having higher therapeutic efficacy with quick action even in small dose. Triturating mineral drugs with herbal liquids (*Bhavana*) increases the efficacy of formulation. *Puta* (incineration) in the preparation imparts *Laghutva* (easily assimilating) property, helps in particle reduction and facilitates nano-particle formation which enhances rapid action of the medicine. However in modern era there is a need for proper standardization of Ayurvedic drugs at various levels starting from the selection and collection of raw material to the final product to provide quality treatment. For this study *Anilari Ras*[1] was selected due to its unique technique for processing of drugs. This technique would satisfy a better quality of output drug. With a hypothesis that systematic blend to all the ingredients of the drug can result in making of highly effective formulation. This classical formulation[1] was selected for pharmaceutical and analytical study to standardise the pharmaceutical process and also find out the standard chemical structure of the drug.

MATRIALS AND METHODS

The raw drugs for *Anilari Ras* were collected from local market in Vijayawada. The experiment was conducted at S.S.Ayurvedic Pharmacy (SSAP), Tirupati and analytical study was conducted at physics department of S.V. University, Tirupati.

Materials used for preparation of the drug are *Shodit parad*[2] (Purified Mercury) 800 gms, *Shodhit Gandhak*[3] (Purified Sulphur) 1600 gms, *Shodit Tamra*[4] (Purified Copper) 800 gms, *Nirgundi patra swarasa (*Juice of *Vitex negundo* Linn.), *Eranda mula kashaya* (Decoction of *Ricinus communis* Linn. Root) and *Citraka mula kashaya* (Decoction of *Plumbago zeylanica* Linn. root*)* The equipments used are *Khalwa yantra* (Mortar), Cotton cloth and Fuller's earth, *Gajaputa* pit & cow dung cakes, *Valuka yantra* (Furnace) & sand and Household stove for *Kashaya* preparation.

Procedure

Purification of Mercury was done by *Samanya sodhana* procedure[2]. *Sudha* (Lime stone) was taken equal to Mercury and triturated in automated *Khalwa yantra* to form a grey colour powder. It was filtered through threefold cloth to obtain Mercury. Later *Lasuna* (garlic)

in equal quantity and Rock salt half the quantity were added to Mercury and triturated till the whole mixture becomes a black coloured paste. The mixture was washed with hot water to obtain purified mercury. Purification of Sulphur is done by *Bhudara puta* method [3].Sulphur was coarsely powdered and spread over a twofold cotton cloth tied to a wide mouthed pot containing milk. The pot was sealed with another earthen vessel and placed inside a pit. Cow dung cakes of two layers were arranged above it while remaining portion is buried under the soil. The Cow dung cakes were ignited and left for self cooling which lasted for 4 hours. Pot was taken out from the pit and purified Sulphur was collected from the bottom of the pot while the impurities rested on the cloth. Purification of Copper sheets was done by *Gomutra tivra pachana* (intense boiling in cow's urine) for a period of one *Yaama* (3 hours) [4].

Purified Mercury and purified Sulphur were taken in *Khalva yantra* (mortar and pestle) triturated for three days to get *Dviguna Gandhaka Kajjali*[5] (Black Sulphide of Mercury) with *Kajjalābha* (black colour), *Rekhapuranatwa* (entering minute pores of fingers) and *Nischandratwa* (lustreless) properties. This *Kajjali* was triturated (*Bhavana*) with *Nirgundi patra swarasa* and *Eranda mula Kwatha* for one day each [6]. For *Bhavana* liquid was added until the whole *Kajjali* was soaked and then trituration was done. Fresh liquid was added time to time and *Kajjali* was collected after it was completely dried.

After that one part of Copper and three parts *Kajjali* was taken for *Puta paka* procedure. Bolus of *Bhavita Kajjali* was wrapped with purified Copper sheets and tied with a cotton thread. Later it was covered by 3 layers of cotton cloth and Fuller's earth. It was then dried in hot air oven. This mud-covered material was placed inside earthen *Valuka yantra* and *Sandhi bandhana* was done. This whole apparatus was placed inside *Gaja Puta* pit containing cow dung powder. *Puta* was ignited and left for self-cooling. After self-cooling *Valuka yantra* was opened and the resultant material wrapped inside Fuller's earth was separated. *Tamra bhasma* (incinerated Copper) thus obtained was 1.8 Kg with a loss of 36%. To this incinerated material again *Bhavana* was given with *Nirgundi patra swarasa, Eranda mula Kwatha & Citraka mula kwatha* for one day each [7].

RESULTS

Analytical tests

The pharmaceutically prepared *Anilari ras* was subjected for certain Analytical procedures like Organoleptic, physico-chemical, SEM, EDS and XRD with a view to standardize the formulation.

Table 1: Classical Characteristics of *Tamra Bhasma*

S.No.	Parameter	Result
1.	*Rekhapurnatva*[10]	Positive
2.	*Varitaratva*[11]	Positive
3.	*Dadhi Pariksha*[12]	Passed

Table 2: Organoleptic tests of *Anilari Ras*

S. No.	Parameter	Result
1	Touch	Soft powder
2	Colour	Dark black
3	Taste	Astringent
4	Odour	Pungent

Table 3: Physico Chemical parameters of *Anilari ras*

S. No	Test name	Values in *% w/w*			Arithmetic Mean of three attempts
		1st time	2nd time	3rd time	
1.	Moisture value [13]	15.23	15.11	15.34	**15.22% w/w**
2.	Total Ash value[14]	85.01	84.58	84.60	**84.73% w/w**
3.	Acid insoluble Ash[15]	15.67	15.46	15.23	**15.45% w/w**
4.	Water soluble Ash[16]	67.50	67.94	67.81	**67.75% w/w**

Table 4: EDS Result of the Quantity of all elements in *Anilari Ras*

ELEMENT	WEIGHT %	ATOMIC%
Cu	27.81	19.91
Hg	19.52	04.16
S	52.66	75.92
Total	100.00	100.00

Table 5: Result of XRD of *Anilari Ras*

Elements/ Molecules	Angle 2θ position	D Spacing (A^0)	Intensity in counts
HgS	26.28	3.37	106
	30.50	2.93	34.32
	43.76	2.06	55
	51.82	1.76	43.21
	54.31	1.68	8.73
	63.60	1.46	7.07
CuS	27.68	3.22	23.45
	29.28	3.05	39.04
	31.73	2.81	60
	32.85	2.72	32.38
	47.94	1.90	38
	52.71	1.74	50
	59.32	1.56	31
S	31.42	2.84	27.43

DISCUSSION

Metallic drugs should always be reduced to *Bhasma* form for internal use. Main aim of present process is to make *Kajjali* react with *Tamra* and reduce it to *Bhasma* form. Most of the reactions that happen between metals and Sulphur are Redox type. Redox is a kind of reaction in which electrons are transferred, thereby oxidizing some atoms, and reducing others[8]. Sulphur readily reacts with metals (by reducing) because of its valency i.e. 2, and tends to gain electrons and becomes S^{-2}. Metals oxidize by sharing its electrons of outer orbits. Rapidity of these reactions depends upon temperature and pressure. If metals were allowed to react with Sulphur in open air most of the sulphur reacts with atmospheric oxygen to form oxides. If the same metal is allowed to react with Sulphur at required temperature in complete absence of oxygen, they form only into metallic sulphides. Before estimating the reactions that may happen in the contents, it is important to note few important salient points of current procedure. Chemicals are completely isolated and sealed from external oxygen.

Copper sulfides exist in a wide variety of compositions, ranging from Copper-rich Chalcocite (Cu_2S) to Copper-deficient Villamaninite (CuS_2) with other intermediate compounds, in-between, such as Covellite (CuS), Djurleite ($Cu_{1.95}S$), and Anilite ($Cu_{1.75}S$). Although, Copper sulphides can be synthesized by a reaction between elemental Copper and Sulphur [9], direct reactions of the elements at low temperatures (<150°C) do not proceed completely because CuS surface layers that formed on copper sheets act as a passivating layer that prevents further reaction. Higher temperatures (>165°C) are required like that of in *Bhasma* making, to enhance reaction and yield pure CuS in the solid-state reaction.

Deep black color of the final product is due to CuS (dark blue) and Meta Cinnabar (Dark black) mixture. Positive result in *Dadhi pareksha* proves *Tamra bhasma* in *Anilari Ras* is of good quality and there is no free elemental copper in the preparation. Total Ash values of *Anilari Ras* is 84.73% w/w which is relatively more because majority of Meta Cinnabar, Sulphur present in the sample evaporates at 450^0C and major portion Copper Sulphide remains stable at that temperature. Unlike the ash colour of organic samples (usually white), ash colour is black due to presence of sulphides of Copper. *Anilari Ras* pH value is 5.8. It is acidic. Covellite, Meta Cinnabar or Sulphur do not contain H^+ ions. But due to *Bhavana* of herbal liquids it was possible to get the pH value of *Anilari Ras*.

Major peaks in XRD were identified as Metacinnabar and Covellite. Minor peaks in XRD graph were of Sulphur. Formation of HgS is temperature specific. Though Mercury reacts with Sulphur at temperature as low as 50°C, it forms into cinnabar only at a temperature more than 450°C. It forms Metacinnabar when process at lower temperatures. Although Cinnabar (red) was formed in the product, it was only found in traces. Hence there were no detectable Cinnabar peaks in XRD graph. Maximum HgS was in the form of Meta Cinnabar. Copper has enough sulphur to react and hence it formed CuS. Stoichiometrically Sulphur is in excess quantity. Clear peak of Sulphur proves occurrence of this phenomenon. It contains large number of non-significant peaks of organic compounds due to presence of plant extracts and powders.

Particle size of drug plays an important role in absorption. Hence the final drug was subjected to analyze through SEM to find its partial size and structure. Particles were spherical to irregular and agglomerated due to presence of organic matter gained from *Bhavana* of herbal liquids. Smallest particle size was found to be ranging between 218.4 nm at 5K magnification to 210.0 nm at 7K magnification. This proves that the drug can be easily absorbed in body and exhibit its therapeutic effect quickly.

CONCLUSION

The standard quality parameters for *Anilari ras* are- EDS shows Hg, Cu and S peak. XRD shows major peaks of Meta Cinnabar (HgS), Covellite (CuS) and minor peaks of Sulphur (S_8). Average grain size in SEM at 5K X is 218.4 nm and at 7K X is 210.0 nm. *Anilari Ras* is a best suitable method of *Tamra bhasma* preparation. This drug can safely used for treatment of different varieties of *Vata vyadhis*.

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Study Photographs

Samanya Sodhita Parada

Purified *Gandhaka*

Purified *Tamra* Sheet

Dwi-Guna Gandhaka Kajjali

Eranda

***Eranda Mula Swarasa* (*Kwatha* Method)**

Nirgundi

Nirgundi Patra swarasa

Citraka Mula

Citraka Mula Swarasa (Kwatha* Method*)

GAJA PUTA PROCEDURE

Wrapping *Kajjali* in *Tamra* Sheets

Cotton thread tied to *Kajjali* wrapped *Tamra* sheets

Covering Earthen *Valuka Yantra* with *Sarava*

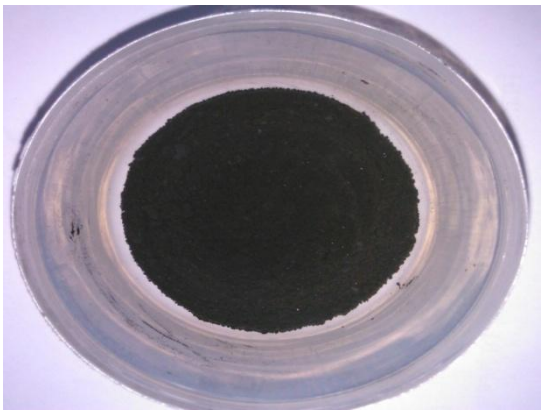
Placing *Valuka Yantra* in *Gaja Puta*

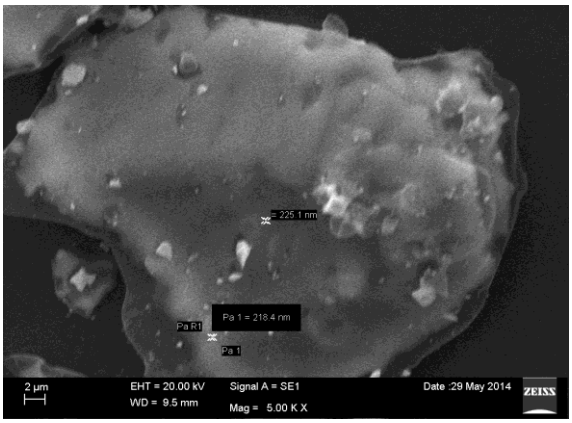
Observations of Incinerated Material

Traces of Cinnabar (Red)

Incinerated *Tamra* along with Meta Cinnabar and *Gandhaka*

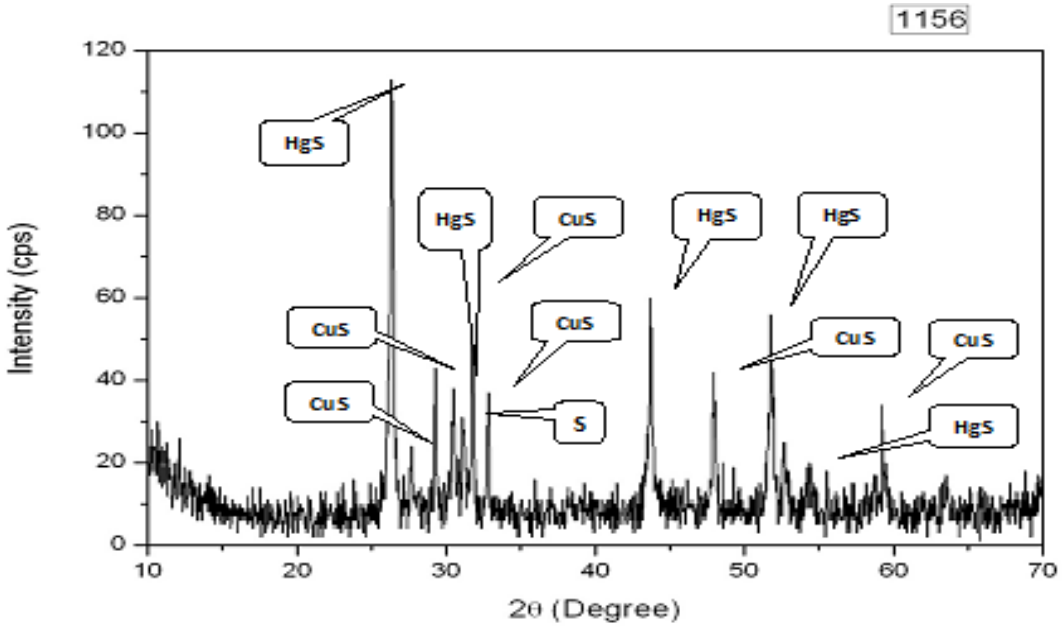
Powder of *Anilari Ras*





SEM Image of *Anilari Ras* at 5K magnification **SEM Image of *Anilari Ras* at 7K magnification**

XRD Graph of *Anilari Ras*



EDS Graph of *Anilari Ras*